REMARKS

Applicant wishes to thank the examiner for the helpful telephone conferences of February 6 and 7, 2006. Applicant also wishes to acknowledge the Examiner's indication in Paragraph 7 of the Office Action that allowable subject matter is present in Claims 8 and 18. Applicant respectfully requests entry of the above amendment, favorable consideration of these remarks, withdrawal of the rejections, and passage of the pending claims to allowance.

The Specification is herein amended to include reference to a Government contract applicable to the present invention. Consequently, all subsequent paragraphs are re-numbered to the next higher number. No new technical matter is added by this amendment.

Rejection of Claims under 35 U.S.C. § 112

In Paragraph 1 of the Office Action, the Examiner rejected Claims 9-11 and 20 under the second paragraph of 35 U.S.C. 112 for improper wording of a Markush group. Applicant has herein amended Claims 9-11 and 20 to replace "selected from a group" with -selected from the group-. Claims 11 and 20 are further amended to remove a redundant listing of indium phosphide (InP). Applicant respectfully requests entry of this amendment, withdrawal of this rejection, and passage of Claims 9-11 and 20 to allowance.

Rejection of Claims under 35 U.S.C. § 102

In Paragraph 2 of the Office Action, the Examiner rejected Claims 1-3, 7, 9-11, 12, and 17 under 35 U.S.C. 102(b) as being anticipated by Charles, U.S. patent 6,289,030. The Examiner states that providing a dry plasma reaction gas mixture to etch through the different semiconductor layers inherently reads on providing a dry plasma reaction gas mixture being chemically selected for, and having an etch rate corresponding to, each semiconductor material layer. Applicant respectfully traverses this statement.

Charles focuses on teaching methods of coating selection, coating application and coating etching, merely stating in Section 2 "Facet Etching" that conventional ion etching methods are preferred. Charles provides some discussion of the chemistry associated with certain dry plasma etching gases or gas mixtures, but neither claims, teaches nor suggests that the etch rate of etchant mixtures sequentially applied enters into a determination of the sequence of their application. Charles teaches only that "a degree of trial and error optimization may be required to adjust the gas flow rate." Therefore, Applicant

respectfully believes that, given the limited discussion of selection criteria in the cited art, the Examiner has over-reached to assume an inherent conscious decision for selection of etchant gas mixtures based on the etch rate and specific chemistry of the etching process as Applicant describes and claims.

Applicant has amended Claim 1 to more particularly point out and distinctly claim that the etchant gas mixtures are selected based on the chemistry involved and that the etch rate of subsequent sequentially applied mixtures is greater than that of previous mixtures as taught in paragraph 0010.

Amended Claim 1 now recites:

> 1. A method of dry plasma etching a semiconductor structure, having a plurality of separately distinct semiconductor material layers on a semiconductor wafer, comprising:
>
> sequentially providing a plurality of dry plasma reaction gas mixtures, each such mixture being chemically selected for, and having an etch rate corresponding to, each semiconductor material layer, the etch rate of each subsequent dry plasma reaction gas mixture being greater than the etch rate of each previous dry plasma reaction gas mixture;
>
> dividing the semiconductor structure into a masked portion and an unmasked portion; and
>
> sequentially exposing the unmasked portion of the semiconductor structure to the dry plasma reaction gas mixtures.

Applicant now clearly claims that etchant mixture selection and sequence is, at least partially, based on etch rate, a consideration not taught or suggested by the cited art. Applicant respectfully believes that independent Claim 1 is now allowable as amended. Claims 2-3, 9-11, 12, and 17 depend from Claim 1 and further identify and claim the present invention. Claims 2-3, 9-11, 12, and 17 are therefore allowable for reason of their dependency. Applicant respectfully requests entry of the above amendment, withdrawal of these rejections, allowance of the pending Claims 1-3, 9-11, 12, and 17, and passage of the pending claims to issue.

In Paragraph 3 of the Office Action, the Examiner rejected Claims 1-2, 4-5, 7, 9-17 and 20 under 35 U.S.C. 102(b) as being anticipated by Shul et al., U.S. patent 5,624,529. Applicant respectfully traverses this rejection. Shul et al. teach dry plasma etching but are silent on selecting etchant mixtures based on etch rate and the use of subsequent mixtures

having higher etch rates than the previous mixture. Shul et al. teach merely the adjustment and control of etch rates by mixture dilution with an inert gas such as argon (Ar). Shul et al. neither claim, teach, nor suggest selection of subsequent etchant gas mixtures based on increasing etch rates. Therefore, Applicant respectfully believes that Shul et al. do not anticipate the present invention as claimed in amended Claim 1 wherein the etchant mixtures are selected based on etch rates and that the etchant mixtures sequentially incrementally vary in etch rate.

Applicant has amended Claim 1 as noted above and respectfully believes that independent Claim 1 is now allowable. Applicant has clearly claimed that etchant mixture selection and sequence is, at least partially, based on etch rate, a consideration not taught or suggested by the cited art. Claims 2, 4-5, and 9-17 depend from Claim 1 and further identify and claim the present invention. Claims 2, 4-5, and 9-17 are therefore allowable for reason of their dependency. Applicant respectfully requests entry of the above amendment, withdrawal of these rejections, allowance of the pending Claims 1-2, 4-5, and 9-17, and passage of the pending claims to issue.

Claim 20 is amended herein to incorporate the allowable elements of Claim 8, correct the Markush wording, and to remove a redundant listing of indium phosphide.

Amended Claim 20 now recites:

> 20. A method of dry plasma etching a semiconductor structure, having at least one semiconductor material layer, on a semiconductor wafer, comprising:
>
> providing a dry plasma reaction gas mixture being chemically selected for, and having an etch rate corresponding to, each semiconductor material layer;
>
> wherein the step of providing the dry plasma reaction gas mixture further comprises providing a first dry plasma reaction gas mixture, providing a second dry plasma reaction gas mixture, and providing a third dry plasma reaction gas mixture,
>
> <u>wherein the etch rate of each subsequent dry plasma reaction gas mixture is greater than the etch rate of each previous dry plasma reaction gas mixture</u>; (emphasis added)
>
> dividing the semiconductor structure into a masked portion and an unmasked portion; and
>
> sequentially exposing the unmasked portion of the semiconductor structure to the dry plasma reaction gas mixture,
>
> wherein the at least one semiconductor material layer comprises a material selected from the group consisting essentially of indium gallium arsenide, gallium arsenide, indium aluminum arsenide, aluminum gallium arsenide,, indium gallium

arsenic phosphide, and indium phosphide.

Applicant now clearly claims that etchant mixture selection and sequence is, at least partially, based on etch rate, a consideration neither claimed, taught nor suggested by the cited art. Applicant respectfully believes that Claim 20 particularly points out and distinctly claims the present invention, and is now allowable as amended. Applicant respectfully requests entry of the amendment, withdrawal of this rejection, allowance of Claim 20, and passage of Claim 20 to issue.

In Paragraph 4 of the Office Action, the Examiner rejected Claim 19 under 35 U.S.C. 102(b) as being anticipated by Shul et al., U.S. patent 5,624,529. Applicant has amended Claim 19 to incorporate the allowable elements of Claim 8 and correct the Markush wording.

Amended Claim 19 now recites:

19. A method of dry plasma etching a semiconductor structure, having at least one semiconductor material layer, on a semiconductor wafer, comprising:

providing a dry plasma reaction gas mixture being chemically selected for, and having an etch rate corresponding to, each semiconductor material layer;

wherein the step of providing the dry plasma reaction gas mixture further comprises providing an initial dry plasma reaction gas mixture, and providing a subsequent dry plasma reaction gas mixture,

wherein the etch rate of the subsequent dry plasma reaction gas mixture is greater than the etch rate of the initial dry plasma reaction gas mixture; (emphasis added)

dividing the semiconductor structure into a masked portion and an unmasked portion; and

sequentially exposing the unmasked portion of the semiconductor structure to the dry plasma reaction gas mixture,

wherein the initial dry plasma reaction gas mixture comprises methane gas and hydrogen gas, and

wherein the subsequent dry plasma reaction gas mixture comprises methane gas, hydrogen gas, and chlorine.

Amended Claim 19 now particularly points out and distinctly claims that etchant mixture selection and sequence is, at least partially, based on etch rate, a consideration not taught or suggested by the cited art. Applicant respectfully believes, therefore, that Claim 19 is now allowable as amended and requests entry of the above amendment, withdrawal of

this rejection, allowance of independent Claim 19, and passage of Claim 19 to issue.

Rejection of Claims under 35 U.S.C. § 103

In Paragraphs 5 and 6 of the Office Action, the Examiner rejected Claims 3 and 6 under 35 U.S.C. 103(a) as unpatentable over Shul et al. in view of Demmin et al., U.S. patent 6,635,185. Applicant respectfully traverses this rejection. Demmin, et al. teach the selection of etchant gas mixtures based on consideration of global warming potential (GWP), but are silent concerning selection of etchant gas mixtures based on etch rates. Thus, Demmin et al. do not overcome the deficiencies of Shul et al. discussed herein above, and do not make obvious the presently claimed invention. Claims 3 and 6 depend from and further limit independent Claim 1 which Applicant respectfully believes is now allowable as amended. Thus, Claims 3 and 6 are allowable by reason of their dependency. Therefore, Applicant respectfully requests withdrawal of this rejection, allowance of Claims 3 and 6, and passage of Claims 3 and 6 to issue.

Allowable Subject Matter

In Paragraph 7 of the Office Action, the Examiner objected to Claims 8 and 18 as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

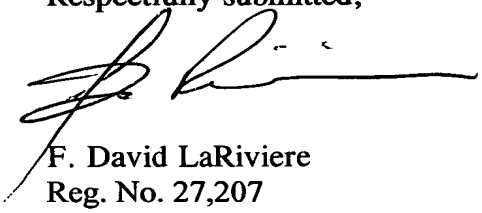
Claim 8 depends directly from independent Claim 1, which has been amended to incorporate the allowable elements language of Claim 8. Amended Claim 1 recites, in part, "sequentially providing a plurality of dry plasma reaction gas mixtures, each such mixture being chemically selected for, and having an etch rate corresponding to, each semiconductor material layer, the etch rate of each subsequent dry plasma reaction gas mixture being greater than the etch rate of each previous dry plasma reaction gas mixture." There are no intervening claims. Thus, Claim 8 has effectively been rewritten in independent form as Claim 1, including all of the limitations of the base claim and any intervening claims. Applicant respectfully requests entry of the above amendment and passage of Claims 1 and 8 to allowance.

Claim 18 previously depended from Claim 7 which depended from Claim 1. Claim 1 is herein amended to include the operative element of Claim 7, "wherein each at least one semiconductor material layer is distinct from one another." Claim 7, therefore, is herein canceled. Amended Claim 1 now recites, in part, "A method of dry plasma etching a semiconductor structure, having a plurality of separately distinct semiconductor material layers on a semiconductor wafer, comprising." Claim 18 is therefore necessarily amended to now depend from Claim 1. There are no intervening claims. Thus, Claim 18 has effectively been rewritten in independent form as Claim 1, including all of the limitations of the base claim and any intervening claims. Applicant respectfully believes that herein amended Claim 1 is allowable; therefore Claim 18 is allowable by reason of its dependency from Claim 1. Applicant respectfully requests entry of the above amendment to Claim 1 and passage of amended Claim 18 to allowance.

Conclusion

Applicant has herein traversed the rejection of the pending claims, amended independent Claims 1, 19 and 20 and dependent claims 9-11 and 18, and canceled Claim 7, as discussed above. Applicant respectfully requests entry of the above amendment, withdrawal of the rejections of Claims 1-20, allowance of the pending claims as amended, and passage of Claims 1-6 and 8-20 to issue. The Examiner is cordially invited to telephone the undersigned for any reason that would advance the pending claims to allowance.

Respectfully submitted,



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